Quantum
Technologies

# Quantum Sensor DMFS-C2

## The Sensor

The DMFS-C2 is a fiber-optical magnetic field sensor, which utilizes the magnetic field dependence of the fluorescence of Nitrogen-Vacancy defect centers (NVs) in diamond to measure magnetic fields. The sensor-head only consists of non-magnetic and non-conducting materials. The DMFS-C2 is an isotropic sensor, the signal amplitude only depends on the magnitude of the magnetic field and not on its direction.

The sensor consists of an optical fiber (Multimode; core diameter: 105µm; NA: 0.22) with an FC/PC connector and the sensor head. The sensor head consists of following parts (see Figure 1):

- **Holder** with a mounting hole for a M4 screw also acting as strain relief.
- **Sensor body** is made of a robust white ceramic tube (length: 200mm; diameter: 6mm).
- **Sensing element** is zirconia ferrule (outer diameter: 1.25mm) with the NV-coated optical fiber inside (diameter: 0.125mm).
  The sensing volume has the dimensions of approximately ⌀150µm x 50µm on the fiber facet.
  In axial direction, the fiber facet is located within 0.5mm to the end of ferrule.
- **Protection cap** made of black rubber, which protects the sensing element from dust and dirt.

An optical interrogator is required to operate the sensor (not included).

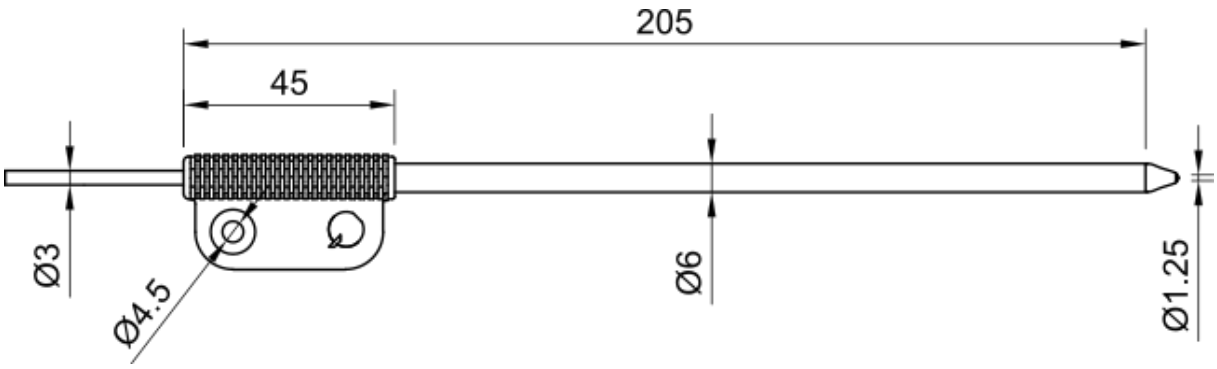


*Figure 1 Drawing of the sensor head. All measures in mm.*

## How to use:

- To utilize the DMFS-C2 for magnetic field measurements, the fluorescence intensity of the NV-centers needs to be measured with an optical interrogator.
  To do this, laser light of a wavelength which excites the NV-centers (e. g. 520nm) needs to be coupled into the fiber via the FC-Connector. At the fiber-tip, the NV-centers are then excited and generate fluorescence photons (wavelength ~600nm - 800nm), which are partly(?) coupled into the fiber and can then be detected e. g. with a photodiode.
  The fluorescence intensity will vary by a maximum of approx. 10% with the magnetic field at the sensing volume (see calibration curve in datasheet).

- When building an optical interrogator to use the DMFS-C2, we want to give the following advice:
  - The photodiode should only detect the fluorescence photons, so the excitation wavelength must be suppressed properly.
  - The magnetic field measurement hinges on an intensity measurement. Care needs to be taken, to have a stable laser source, as intensity variations of the laser (e.g. due to temperature or noise) could otherwise be misinterpreted as magnetic field fluctuations.
- When connecting the sensor to an optical interrogator, make sure that the fiber connector is clean.
- The optical fiber is a sensitive component, do not bend too tight or buckle the fiber.
- Do not put mechanical force on the sensor tip, it might permanently damage the sensing element.
- When using a Laser as excitation source, make sure to obey Laser safety rules.
- Do not insert in human body.

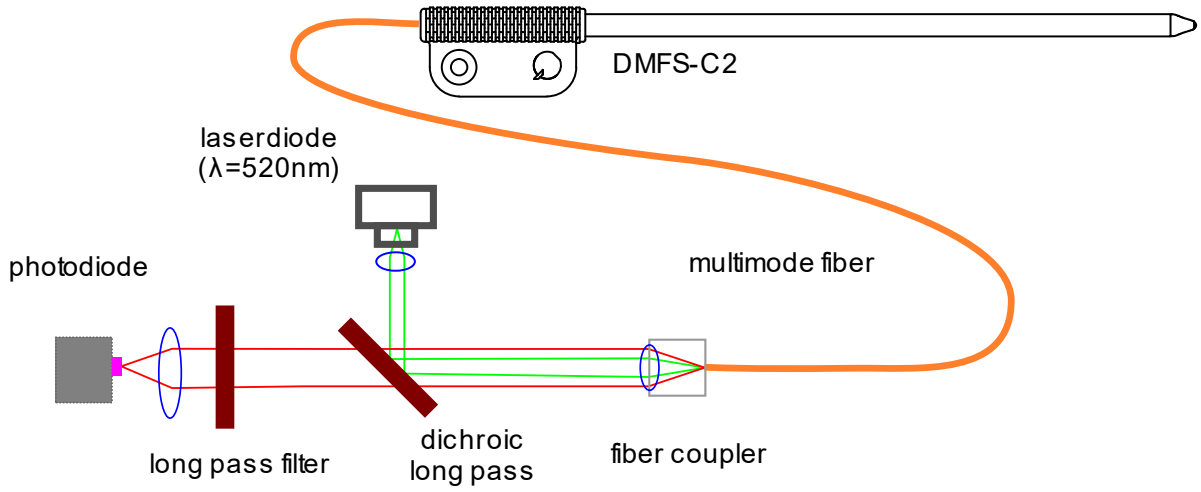


*Figure 2: simple schematic of an optical interrogator to use the DMFS-C2.*